

POWERTRONIX®

UNINTERRUPTIBLE POWER SUPPLY

USER MANUAL

VELA 50-60 kVA



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1 UPS GENERAL INFO

1.1 UPS GENERAL DESCRIPTION

These UPS families have the compact construction, with the outer metal frame and the electronic circuits and power components inside. All user accessible elements and the control panel are placed on the front side.

The top and side covers can be removed, giving an access to the internal part of the UPS for the service or maintenance purposes.

The front side of all units contains the user interface panel useful for monitoring, maintenance and control.

The UPS has a air forced cooling system, the air is going out to the back side of the cabinet.

The terminal block for the electrical connection to the mains, reserve, load, external batteries, and the main circuits breakers, are located on the front side of the unit.

1.1.1 UPS APPLICATIONS

The new UPS family was designed to provide stabilized and filtered power, especially for supplying sophisticated and sensitive electronic devices (i.e. for data processing systems). Vela UPSes can be used to supply electronic systems of medical centers, police stations, motorway tunnels, broadcasting stations, banks, technical and administrative offices, requiring the power source free from voltage and frequency variations.

1.1.2 POWER AND AUTONOMY

Thanks to its modular design, the UPS models are available with rated power from 50kVA to 65kVA

For all the size of the family are not available the internal battery, an or more external battery modules can be used to increase the UPS autonomy.

1.1.3 SAFETY AND SIMPLICITY OF USE

All the UPS elements available for user daily maintenance are insulated and disconnected from hazardous voltages.

Control of the overload and excessive temperatures guarantees the immediate and most suitable intervention in the case when one of these conditions occurs during operation.

The operator can view the UPS status on the front panel and perform shut down or switching operations easily (see chap. 3)

The unit is provided with the E.P.O. (Emergency Power Off). This function is activated by pressing the button located on the front panel.

A remote E.P.O (optional) switch can be connected to UPS to provide remote emergency power off action.

The UPS state can be easily monitored with the personal computer and an interacting program (optional) or through the remote panel (optional), especially when the UPS is installed in unmonitored areas. Refer to the chapters 1.2.5 - 1.2.6.

1.2 CONFIGURATIONS AND OPTIONAL EQUIPMENTS

1.2.1 BASE CONFIGURATION

The UPS is available in the following configurations:

- Six pulses configuration 50-60 kVA
- 12 pulses configuration 50-60 kVA
- 12 pulses configuration + low THD 50-60 kVA



1.2.2 BATTERY CABINET

If required, the UPS can be furnish with additional optional battery cabinet to increase the autonomy
All the batteries will be mounted in a separate cabinet with opportune dimensions complete of power circuit breaker and protections.

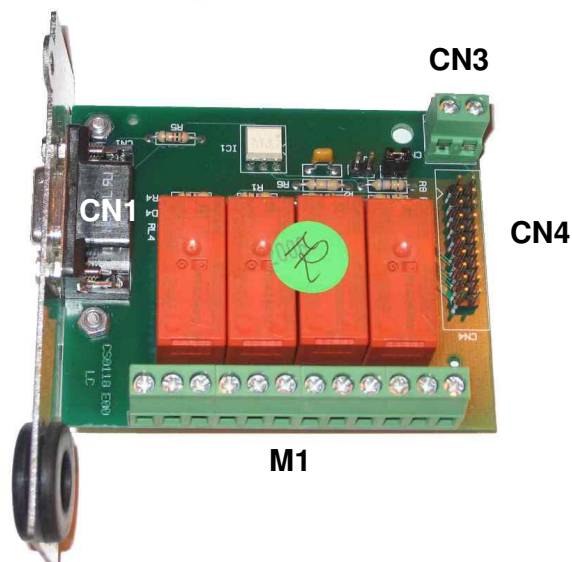
1.2.3 TRANSFORMER CABINET

If required, there is available a galvanic isolating transformer, positioned in a separate cabinet.
The standard transformer is three-phase/three-phase (or single-phase/single-phase or three-phase/single-phase) with 1:1 ratio, but it can be supplied with a different transformation ratio upon customer request.

1.2.4 CIRCUITS FOR REMOTE COMMUNICATION

Remote communication board (the code CS0118), gives possibility of monitoring and communicating with UPS.

Monitoring can be implemented with the PC and dedicated software or through a remote panel. There are also voltage free contacts available on the terminal board M1 (more info at page 18).



1.2.5 UPS MANAGEMENT SOFTWARE

The "UPS MANAGEMENT" Generex communication software allows interaction between UPS and PC or the network based on Windows, Win-NT, Novell, OS2, Dec, and Linux operating systems.

The software is used to monitor and control parameters of one or more UPS units supplying the network (more info at page 22)



1.3 REMOTE PANEL

The remote panel is used for remote viewing of the UPS state; it shows the status of the main UPS blocks with LED indicators and the sound signalization in the case of alarm conditions (more info at page 21)



1.4 REMOTE E.P.O. PUSHBUTTON

The remote E.P.O push-button provides the safe, remote way to fast and full disable the unit running in the event of an emergency (more info at page 22)

1.5 OPERATING THEORY

The UPS described here is an on-line dual conversion type UPS, with automatic by-pass in compliance with European standard EN62040-1-2. This UPS performs the dual conversion of the incoming voltage continuously and without interruption.

The absence of direct connection between mains and load eliminates the possibility of carrying disturbances from mains to the load. The dual conversion technique guarantees to the load delivering energy regulated both in voltage and frequency - thus ideal for the operation of professional applications. When the input voltage exceeds the allowed range or - more simply - is not present, the load is supplied by energy transferred from the batteries.

The system is supplied with an automatic by-pass; in the event of the UPS fault or overload the by-pass connects the load directly to the mains via a reserve line, making possible maintaining normal load operation without supply interruptions. See the fig. 1.5.1

1.5.1 UPS BLOCK DIAGRAM

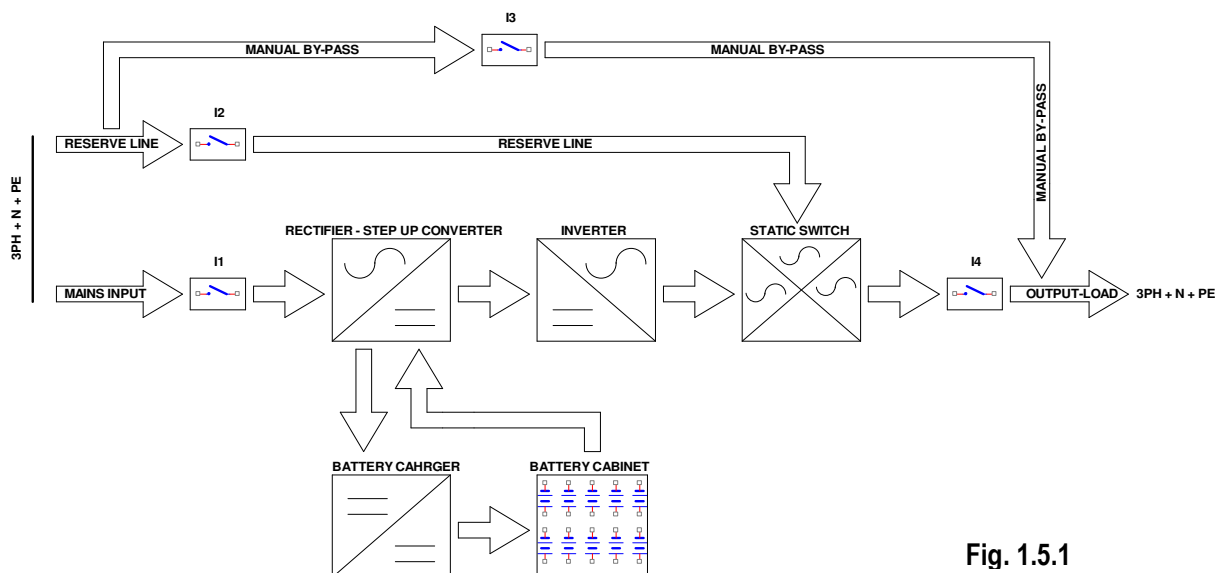


Fig. 1.5.1

1.5.2 INPUT STAGE, POWER MODULE AND OUTPUT STAGE

From the input bars the mains voltage is connected through the MAINS INPUT I1 switch to the power module.

The rectifier-step-up converter controlled by the control logic, performs the AC/DC conversion of the mains voltage (during normal operating conditions) or the DC/DC conversion of the battery energy when the mains power is absent or not within the allowed range.

The DC voltage from the converter powers the inverter module, which creates AC voltage, adjusting the current depending on the load needs.

The last module is the automatic by-pass. It transfers the filtered and regenerated energy from the inverter module to the load during normal operating conditions, or - when UPS fault or overload occurs - from reserve line, still providing the energy to the load. When disappears the cause which forced UPS to switching to the reserve line, the by-pass automatically switches the load to the inverter power source.

The filtered, regenerated and stabilized mains voltage supplies the load through the UPS OUTPUT (I4) switch. Refer to the figure 1.5.1

1.5.3 LOGIC AND AUXILIARY CIRCUITS

The control logic occupies the separate board (CS0119) and represents the “intelligence” of the UPS. It manages operations of the step-up converter, inverter and by-pass, based on feedback signals taken from the power module. The control logic also manages the other three boards: the battery charger, auxiliary power supply and signal interface.

The battery charger handles recharging of the outside batteries connected to the UPS.

The signal interface receives the signals from the control logic and converts them into the protocol required by the front panel of the UPS and also the relays board. Going backwards, the selected commands from the front panel (automatic by-pass forcing) and/or relay board (EPO) are sent from the signal interface to the control logic which interprets them and performs desired operation – like switch on/off inverter or shut down the unit.

The signal interface, except controlling standard relays board, can also control another (optional) one.

The auxiliary power supply supplies all the boards and electronic components in the UPS.

1.5.4 BATTERIES

The battery set provides energy to the system when the input mains is out of the allowed range or not present; in all other cases batteries are constantly recharged by the charger module. In this way the batteries are always ready for use when required.

1.5.5 MANUAL BY-PASS

The manual by-pass is useful in the situations, when it is necessary to disable the UPS and keep the load supplied by the mains (i.e.: UPS stopped, fault, etc.). can be activated with using the MANUAL BY-PASS (I3) switch, located in the front part of the UPS (refer to chapter 4). In normal operating conditions this circuit breaker remains in rest position, protected with the mechanical lock (the padlock).

1.5.6 FRONT PANEL

The UPS can be managed via the front panel. Using the panel it is possible to execute the commands, display states and measurements and reset the alarm circuits.

The panel is equipped with an LCD screen used to display the operating status of the UPS, the load and all types of measurement (see chapter 3)

2 INSTALLATION INSTRUCTIONS

2.1 GENERAL INFORMATIONS

This chapter describes the system installation procedures and lists the following subjects:

- 2.2 Reception and identification
- 2.3 Storage
- 2.4 UPS positioning
- 2.5 Room specifications
- 2.6 Arrangement and connection to mains
- 2.7 UPS Auxiliary connections
- 2.8 Earth connection

2.2 RECEPTION AND IDENTIFICATION

After removing the packing, visually inspect inside and outside the UPS and battery module (if included) to check for any damage that could occur during shipping. If there is any damage, inform the shipper or retailer immediately.

Check the supplied material against the packing slip.

The machine has an adhesive identification plate indicating the type, power and serial number; it is located on the right door (fig.2.2).

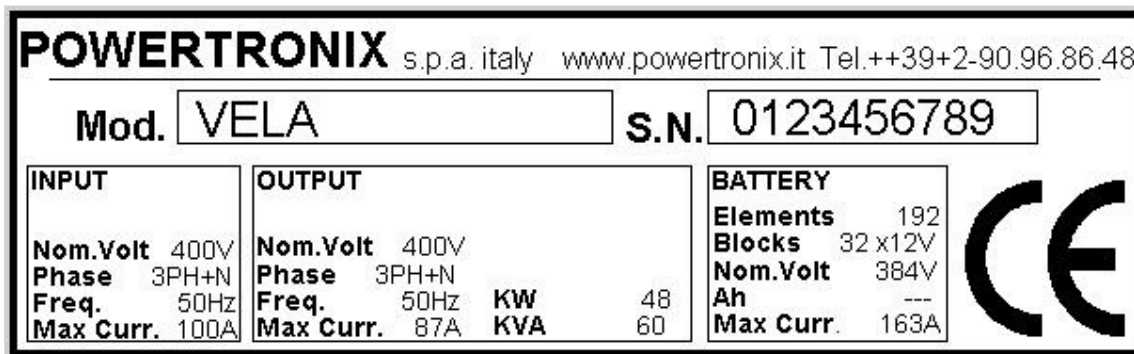


Fig. 2.2

2.3 STORAGE

If the system is not going to be installed immediately it must be stored in an environment with adequate protection against excessive humidity and sources of extreme heat (from +5 to +40°C, humidity less than 95% without condensation).

If the battery module is supplied, also make sure that no more than 6 months pass between one battery recharge and the next. Once this period of time has elapsed, temporarily hook the UPS up to the mains and run it for the time needed to recharge the batteries.

2.4 UPS POSITIONING

All the size and configurations are developed in the same cabinet with the characteristics described in the tables 2.4a-b-c below:

6 PULSES VERSION (STANDARD)		
POWER (kVA)	DIMENSIONS W x D x H (mm)	WEIGHT (Kg)
50	530 x 950 x 1220	196
60		196

Tab. 2.4a

12 PULSES VERSION		
POWER (kVA)	DIMENSIONS W x D x H (mm)	WEIGHT (Kg)
50	530 x 950 x 1220	330
60		330

Tab. 2.4b

12 PULSES VERSION + LOW THD		
POWER (kVA)	DIMENSIONS W x D x H (mm)	WEIGHT (Kg)
50	530 x 950 x 1220	370
60		370

Tab. 2.4c

For handling you need to remember that the machine, unless special arrangements are made, is shipped and thus handled, thus you need to refer to the higher weight of the version used.

All the connections are located in the rear panel and can be reached by just removing the cover as shown on the fig. 2.4

Fig. 2.4 shows the external connections.

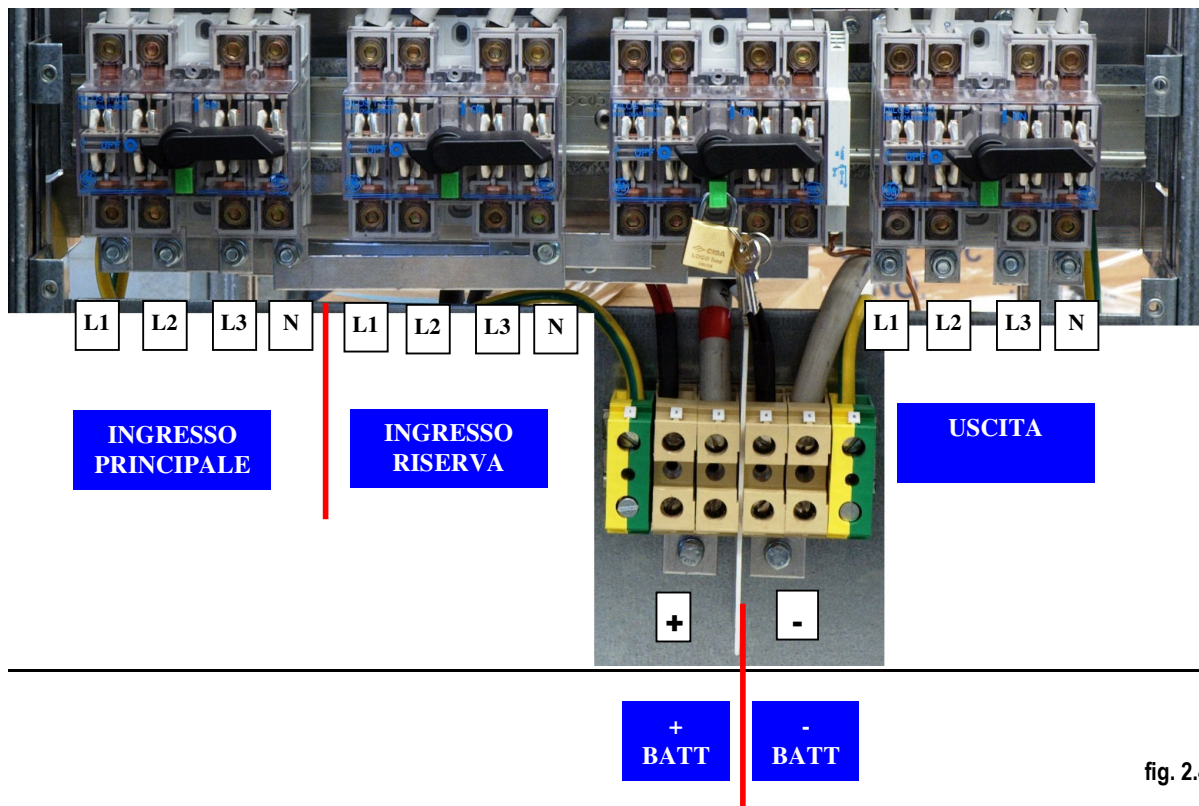


fig. 2.4

Looking at the front, the cables input is located on the lower side and accessible after opening the main UPS door (fig.2.5)

For the cables connection according to the UPS configuration refer to fig.2.4

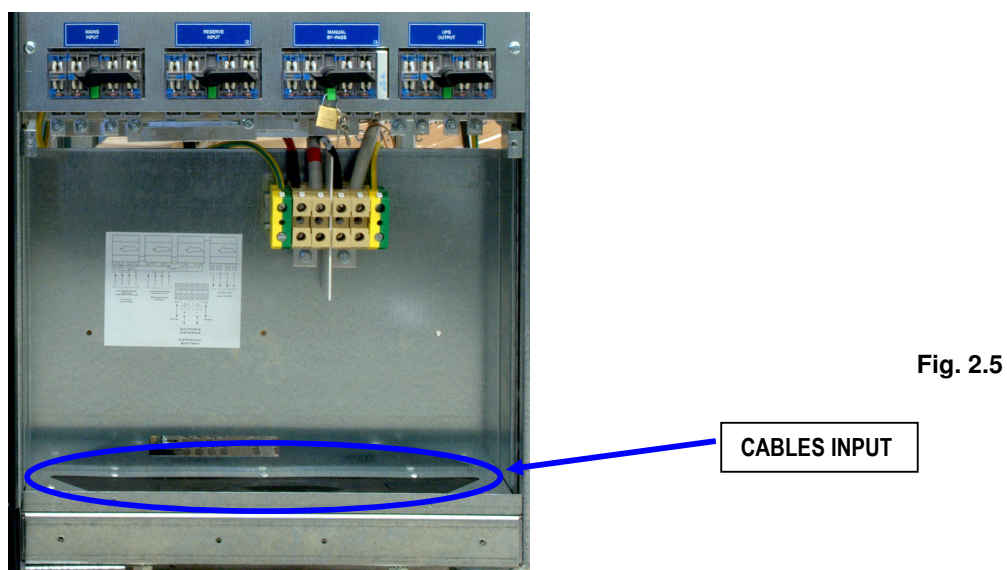


Fig. 2.5

2.5 ROOM SPECIFICATIONS

The room where the UPS is installed must be clean; it must have pollution class 2 (CEI) and must be able to dissipate the heat produced by the machine, as shown in table 2.5a.

Tab. 2.5a

Power	
Rated power (kVA)	Power dissipation (kW)
50	4
60	4.8

For correct battery ventilation, the room must be able to ensure an exchange of air equal or greater than the value shown in table 2.5b.

Tab. 2.5b

Air exchange <u>only</u> for battery hydrogen		
Air exchange for 15' auton. (m ³ /h)	Air exchange for 30' auton. (m ³ /h)	Air exchange for 1h auton. (m ³ /h)
10	19	32

Remember that the average life of the batteries is closely correlated with the operating temperature; a temperature of around 20°C is normally recommended.

(when the temperature rises above 20°, for each 10° higher the battery life drops by 50%)

2.6 CONNECTIONS AND LAYOUT TO THE MAINS

For connection to the mains a layout solution like the one shown in diagram 2.6 is recommended. The circuit breakers B-C-D are magnetothermal type without differential protection, or if this is required, with a triggering current greater than 0.3A, delayed and suitable for load with DC current (type A). Switch A is used as external BY-PASS.

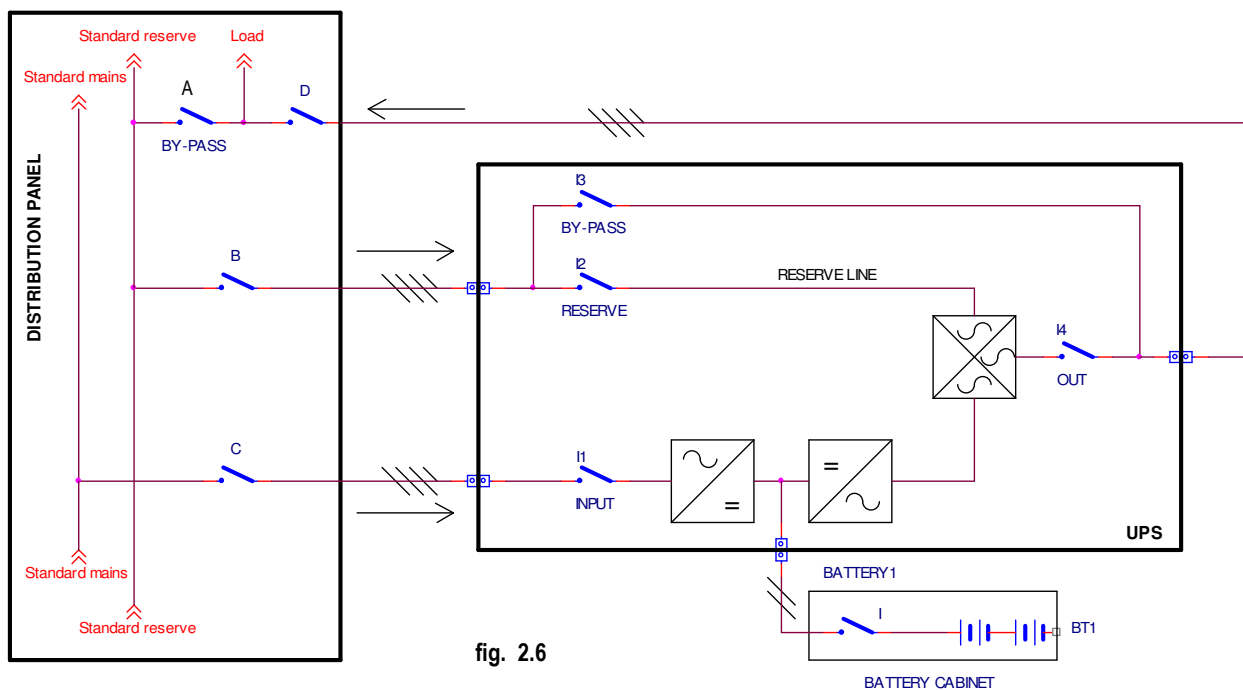


fig. 2.6

The control parts and all the power connections of the UPS in question need to be able to permanently support the current shown in tab. 2.6

UPS power (kVA)	Mains input I _{max} (A)	Reserve input I _{max} (A)	User outputs I _{max} (A)	Battery discharge current (A)
50	75	76	76	140
60	90	91	91	166

Tab. 2.6



WARNING !!



IN ADDITION TO THE CIRCUIT BREAKER AND PROTECTION IT IS ADVISABLE TO SET UP AN APPROPRIATE CHANGE-OVER CONTACT ON THE INPUT SIDE OUTSIDE THE UPS TO PROTECT AGAINST VOLTAGE RETURNS, AS INDICATED IN TABLE 2.6 AND THE FOLLOWING DRAWING:

If necessary for the Vela series 50-60kVA, a system against voltage return needs to be created in the UPS distribution panel as shown in diagram 2.6b

- A: general mains circuit breaker / switch
- C: automatic switch or at least a fuse for the mains
- B: automatic switch or at least a fuse for the reserve network
- K3: protection contactor against return voltage
- K1-K2: additional relays on the change-over contact coil supply

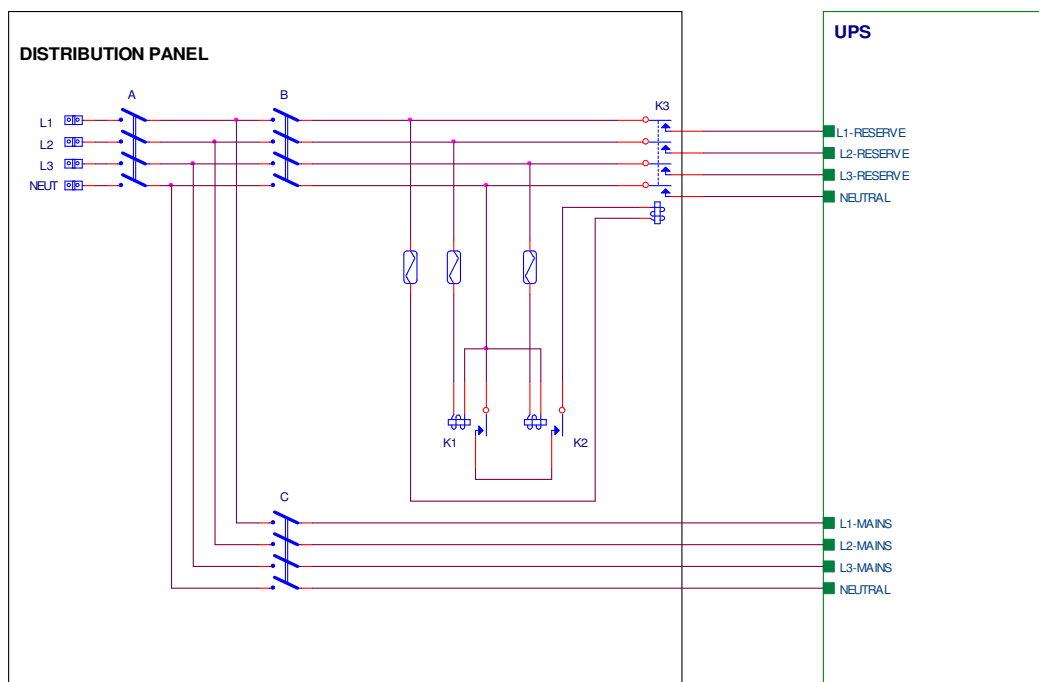


fig. 2.6b



WARNING !!



BEFORE CONNECTING THE UPS MAKE SURE THAT THE LINES WHICH CONNECT THE UPS MAINS AND RESERVE INPUT TO THE DISTRIBUTION PANEL ARE OPEN AND DISCONNECTED.

MAKE SURE THAT THE BATTERY PANEL SWITCH IS OPEN.

PUT WARNING SIGNS ON THE DISTRIBUTION PANEL AND BATTERY PANEL TO PREVENT ACCIDENTAL ACTIONS.

If not required, the UPS is supplied with mains and reserve line in parallel (fig.2.6c). It is possible to separate them by removing the connecting bars.

Before connecting the UPS it is necessary to:

- make sure that the mains voltage and frequency match those indicated on the adhesive plate located on the rear side of the UPS (input voltage, operating frequency, etc.);
- make sure that the earth connection of the system fully complies with the requirements of IEC standards or local laws.

After that install four pole circuit breakers upstream and downstream from the UPS with the following specifications:

- rating equal or greater than what is indicated on the label on the UPS rear (kVA);
- specifications in compliance with IEC standards or local laws for "Curve C" circuit breakers.

The connections must be created using a flex cables with the section as recommended in a table below

P (KVA)	Ø A.C. (mm²)	I A.C. (A)	Ø D.C. (mm²)	I D.C. (A)
50 (KVA)	16	76	50	140
60 (KVA)	25	91	70	166

2.7 UPS AUX CONNECTIONS

The communications boards are mounted over the power circuits breakers.

The standard equipment is composed of the remote communication board (CS0118) and set-up for the SNMP board.

It is possible to connect a second (optional) communication board (CS0118) in addition to the standard as shown in a fig.2.7

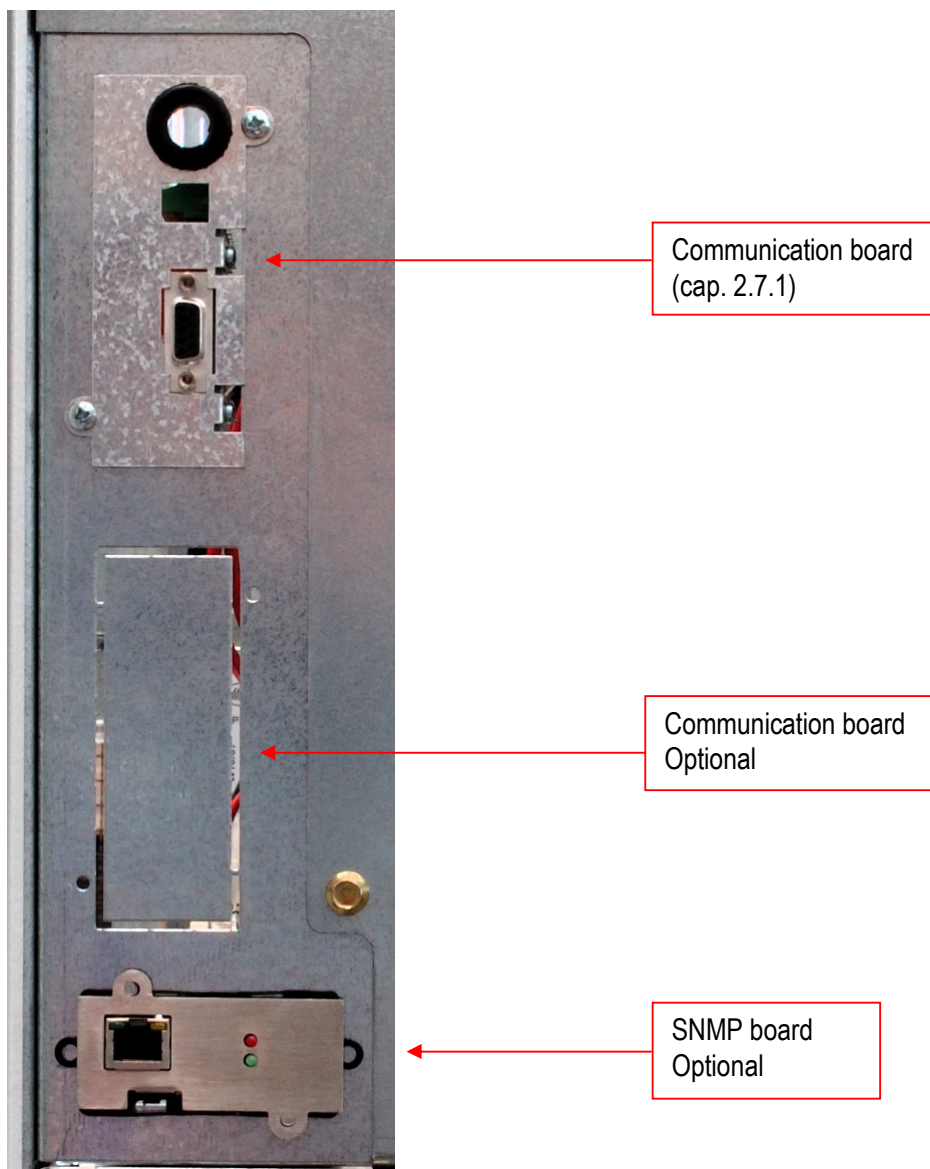


fig. 2.7

2.8 REMOTE COMMUNICATION BOARD

Remote communication board is used to allow connection between the UPS and external devices. The board has a series of voltage free contact terminals (M1) which can be connected to a dedicated synoptic panel (chap. 2.8.1), acoustic or visual warning devices or remote signaling systems. One or more remote EPO buttons (chap. 2.8.3) can be connected via the other two contacts (CN3). On the card are present two jumper, they must be configured as below :

JP5 → CLOSED

JP6 → OPEN

Lastly, it is possible to connect the system to a PC via a DB9 (CN1) connector and use the specific software (chap. 2.8.2)

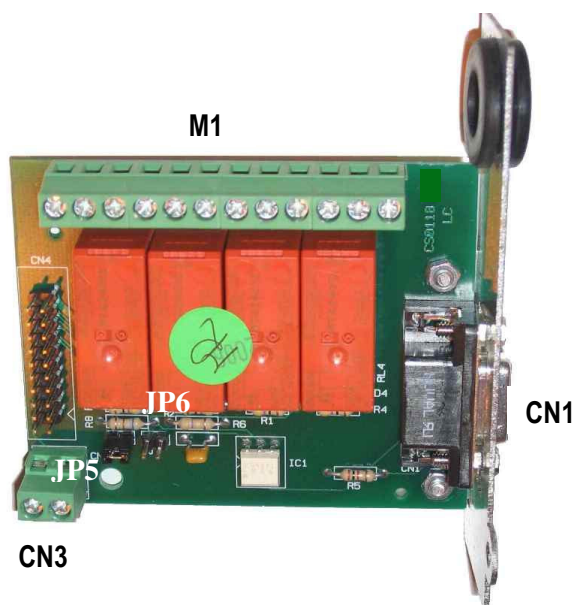


fig. 2.8a

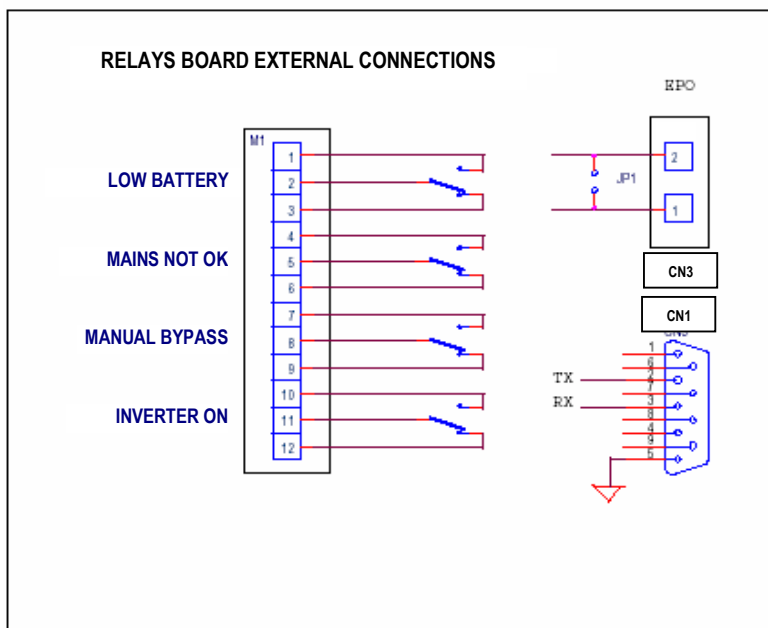


fig. 2.8b

2.8.1 REMOTE PANEL (OPTIONAL)

Remote panel is connected to the UPS via the terminal board M1 located on the remote communication board (CS0118)(connection diagram fig. 2.8b). This device is used for remote monitoring of the main UPS blocks, the status of the main blocks is represented through LED, and there is also an acoustic alarm, which can be shut off with key 5.

LED description

1) Green ON UPS LED

If it's on, the UPS is operating correctly

If it's off, indicates that one or more inverter section alarms are present
(acoustic alarm enabled)

2)Yellow ON BATTERY LED

If it's on, the UPS is operating on battery
(acoustic alarm enabled)

3) Red LOW BATTERY LED

If it's on, indicates imminent end of battery discharge
(acoustic alarm enabled)

4) Yellow ON BYPASS LED

If it's on, indicates load supplied from reserve
(acoustic alarm enabled)

5) ALARM SILENCE key

Used to switch off the acoustic alarm

6) Green LED

If it's on, indicates correct power supply connected to the panel

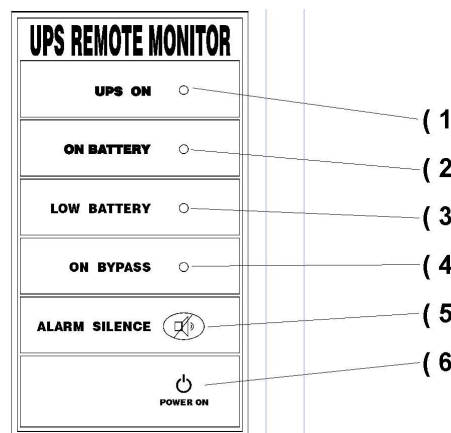
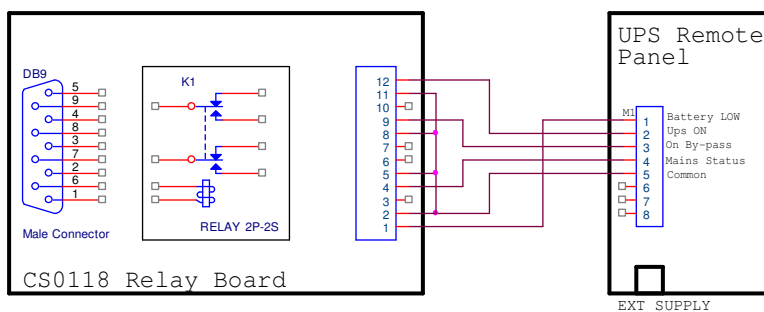


fig. 2.7.2b



CS0118 Relay Board		UPS REMOTE PANEL
1	=====	1
2, 5, 8, 11	=====	5
4	=====	4
9	=====	3
12	=====	2

NOTE:

ON CS0118 COMMON TAGBLOCKS MUST
BE LINKED TOGETHER

2.8.2 UPS MANAGEMENT SOFTWARE

This software is used to monitor the conditions of the UPS via a PC connected to the system by the supplied cable.

For more information on the installation and use of the software see the user manual which came with it.

2.8.3 REMOTE E.P.O. PUSHBUTTON

Particular attention must be paid to the external connection of buttons or actuators for the EPO function (emergency stop). This connection is composed of a series or normally-closed switches which open the series if commanded, generating the stop of the UPS with the consequent and irreversible interruption of voltage to the load. The series of external EPO buttons must be connected to the CN3 terminal board of the relay board CS0118 (Fig.2.8.3). If there are no external EPO contacts to the **system jumper JP5 must be enabled.** (fig.2..7.4)

The default configuration (with any ext. E.P.O connected) has the connector CN3 shortened with a wire connection, it must be removed (as well as the jumper JP5), when one or more E.P.O. ext. is connected to the board as described above

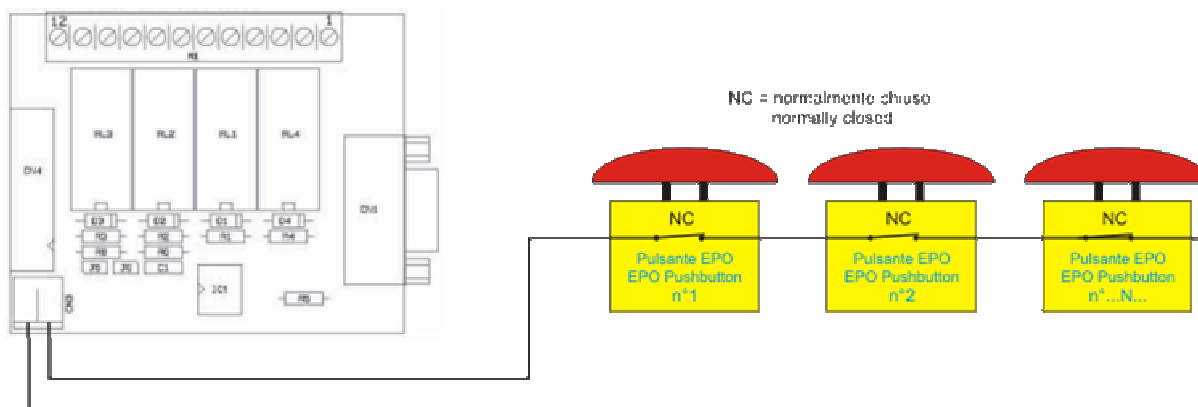


Fig. 2.7.4

2.9 EARTH CONNECTION

The earth input cable must be connected to the earth terminal of the UPS and **must be always the first cable to be connected.** It is advisable to insert an appropriate antioxidant between the earth bar and lug to keep the accurate contact over time.

All of the cabinets and accessories must be earthed in accordance with local regulations.




WARNING!!




INADEQUATE EARTH CONNECTION MAY CAUSE A RISK
OF ELECTRIC SHOCK TO PERSONNEL OR OF FIRE

3 CONTROL PANEL

3.1 INTRODUCTION

The control panel is located on the upper front part of the UPS, and it's used for easily check the general status of the UPS and batteries and related alarms.

The panel contains an LCD screen (which indicates the operating status, measurements and alarms of the UPS) and the red EPO button located on the right side below the display.

The display panel shows text messages and operating parameters on an LCD screen with 4 lines and 20 characters per line.

The screens are organized in 5 multi-level menus, which can be selected using the membrane buttons under the LCD display.



fig. 3-1a

On the left side of the display there are two LEDs, the green one called “NORMAL” and a red one called “ALARM”.

The actions of the LED are summarized in the table 3.1a

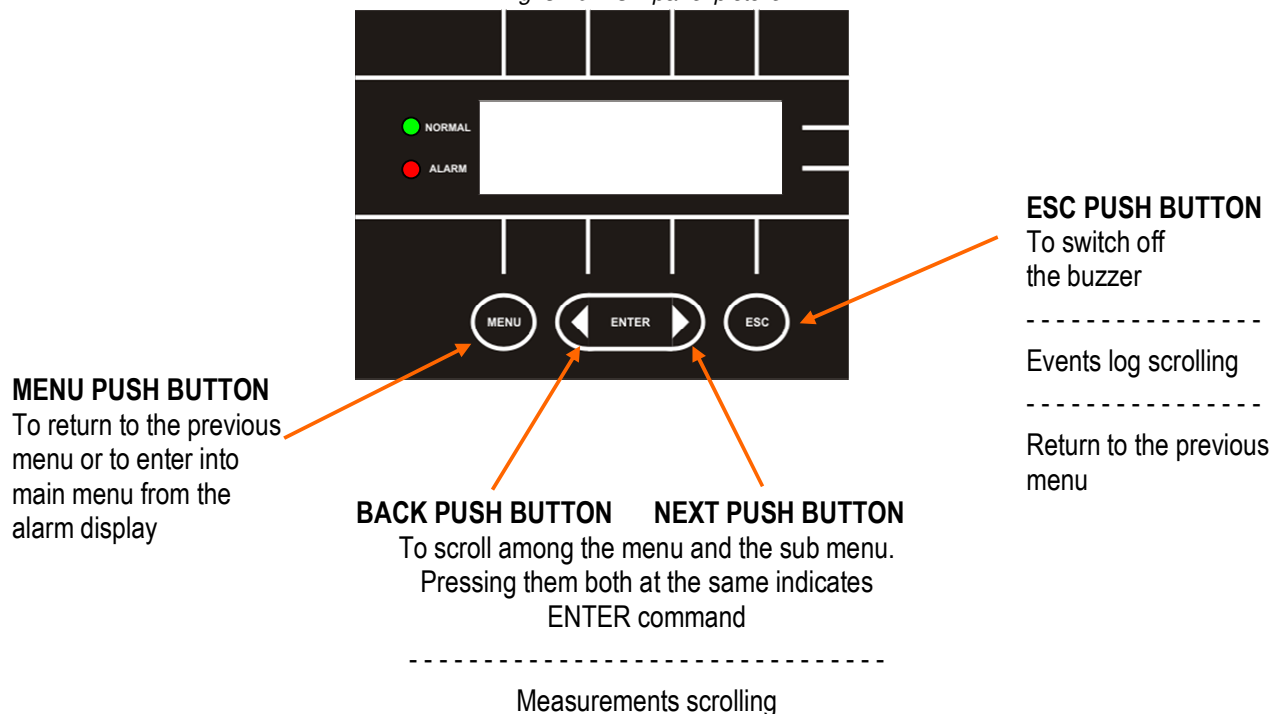
STATUS	UPS OK	Alarm present	Alarm stopped
GREEN LED	ON*	OFF	ON
RED LED	OFF	ON	OFF

Tab 3.1a

On the control panel of master UPS in the parallel system, for its identification as a master, the normal operation is indicated by flashing green LED.

3.2 LCD CONTROL PANEL

Fig. 3-1b LCD panel picture



During normal UPS operation the control panel presents the series of messages to indicate the operating status of the components of the system, therefore the operator is informed in real time (also with sound signal) about any faults occurred in the system.

Table 3.1b summarizes the list of available menus.

MENU	N°	NOTES
COMMAND MODE	1	<i>Inverter switch on and off, static switch, battery test</i>
EVENTS HISTORY	2	<i>Displays the log of events and alarms</i>
OPERATING LANGUAGE	3	<i>Enables the change of interface language</i>
CLOCK	4	<i>Date and time settings</i>
UPS CONFIGURATION	5	<i>Measurements adjustments and relays board test</i>

Table 3.1b

It's possible to move among 5 menu positions listed above, using the NEXT(>) or BACK(<) keys.
 Both the keys NEXT(>) and BACK(<) pressed simultaneously imply the ENTER command, which is used to confirm the actual menu selection and to change the menu level.
 To return to the previous menu level press the MENU key.
 Each alarm indication on the display is followed by a sound signal which can be switched off by pressing ESC (see figure 3.1b).

3.3 UPS STATES AND ALARMS VISUALIZATION

This menu state characterizes the first line of the message which can be UPS OPERATING (if the UPS is operating normally) or UPS ALARM (if UPS experienced the alarm condition). The meanings of the displayed messages are described below:

UPS IN NORMAL OPERATING CONDITIONS

LCD MESSAGE	MEANING
MAINS WITHIN LIMITS / MAINS OUT OF LIMITS	The input mains line is on and the voltage is / is not in the specified range
BY-PASS LINE WITHIN LIMITS / BY-PASS LINE OUT OF LIMITS	The input by-pass supply line is on and the voltage is / is not in the specified range
BATTERY VOLTAGE WITHIN LIMITS / BATTERY FAILURE	The battery voltage is within the specified limits
INVERTER OPERATING	The inverter is on and operating normally
INVERTER - BY-PASS LINE SYNCHRONISED	Indicates the normal synchronization status between the inverter and by-pass line
LOAD ON INVERTER	The load is supplied by the inverter
LOAD ON BY-PASS LINE	The load is supplied by the by-pass line. This may be a temporary condition which lasts 20 seconds after short overload
UPS MASTER*	Controls the other UPSes in parallel system
UPS SLAVE*	Controlled by another UPS in parallel system

Table 3.3

* For units in parallel system only

3.4 MEASUREMENTS

To access to this section, press ESC pushbutton on the main menu.

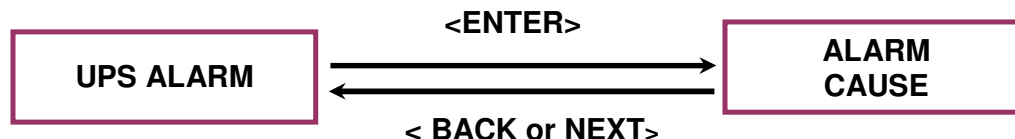
The operator can now check the value of the following electrical measurements by using the arrows < or >:

V in phase – neutral	=	reserve line Y-voltage
V in phase/phase	=	reserve line voltage between lines
Input current	=	UPS input three phase currents
V out phase - neutral	=	UPS output Y-voltage
V out phase/phase	=	UPS output voltage between the lines
Output current	=	output current at load
Battery V,I	=	battery voltage and current
Frequency	=	UPS output frequency
UPS Temperature	=	Cabinet temperature
Power	=	Power measured at the output of the UPS (kVA)
UPS configurations	=	Power save on/off output frequency 50/60Hz

If no operation is performed for 3 minutes, the “UPS STATUS AND ALARMS” menu is displayed.

3.5 UPS IN FAULT CONDITIONS

If the UPS experiences the fault, the normal status message will be replaced with the alarm one. An alarm message will differ depending on the type of fault which occurred. Activated sound signal can be switched off by pressing the ESC key. The ENTER (< >) key can be used to display the list of indications which let the operator to understand the meaning of the alarm. The <BACK or NEXT> keys can be used to scroll through all the active alarms. When the alarm cause disappears, the LCD will return to the default message.



The possible alarms and associated with them help messages are listed below.

ALARM MESSAGE	MEANING
INVERTER OFF	The load is no longer supplied by the inverter and subject to any mains failures
INVERTER OVERLOAD	The inverter is off due to an overload and the load is supplied by the reserve network
STATIC SWITCH LOCKED	After 3 unsuccessful automatic switching attempts from the reserve to inverter, the UPS blocks the static switch in the reserve network position
BATTERY TEST FAILURE	Displayed whenever the periodic test on the battery fails for any reason
BATTERY PRE-ALARM	At the battery voltage of around 345V the UPS warns the user of a low battery voltage At 320V discharging ends and the UPS switches off
STATIC SWITCH FAILURE	At least one of output phases is missing
MANUAL BYPASS ON	The manual bypass switch has been closed
MAINS OUT OF LIMITS	The mains voltage is out of allowed specification, it might be out of the range allowed by the system, or simply not present
BY-PASS OUT OF LIMITS	The reserve is out of allowed specification, it might be out of the range allowed by the system, or with incorrect cyclic direction, or not present
EMERGENCY POWER OFF	Displayed whenever the E.P.O. button is pressed
PARALLEL DATA EXCHANGE FAILURE	This alarm occurs when there is, for any reason, no data exchange between UPS units in parallel. It may be due to a missing or incorrect connection of one or more parallel fibers
BATTERY CHARGER FAILURE	Battery charger doesn't work properly or is not connected

3.6 MENU 1: UPS COMMANDS

Using this menu it is possible to control operation of the UPS. All commands must be confirmed by the user by pressing ENTER.

MESSAGE	INTERPRETATION
INVERTER ON/OFF	The inverter will be permanently switched on or off. It is necessary to switch on the inverter during unit startup or after the stop caused by permanent overload.
SWITCH LOAD	Depending on the actual state, the load will be switched to the reserve line or to the inverter.
BATTERY TEST	An automatic 30 seconds long battery test will be executed.

If no operation is performed for 3 minutes, the "1. UPS STATUS AND ALARMS" menu will be displayed

3.7 MENU 2 : EVENTS HISTORY

MESSAGE	INTERPRETATION
DISPLAY EVENTS	Displays maximum 1024 last events in chronological order
DELETE EVENTS	Removes all events stored in the UPS memory

If no operation is performed for 3 minutes, the "1. UPS STATUS AND ALARMS" menu will be displayed

3.8 MENU 3 : OPERATIVE LANGUAGE

Using this menu option, the user can change the panel language.

If no operation is performed for 3 minutes, the "1. UPS STATUS AND ALARMS" menu will be displayed

3.9 MENU 4: CLOCK

Using this menu option, the user can set the actual date and time.

If no operation is performed for 3 minutes, the "1. UPS STATUS AND ALARMS" menu will be displayed

3.10 MENU 5 : UPS CONFIGURATION

This menu entry is used to configure and adjust measurements results presented on LCD display and to test the relays board.

Access to this menu option has the authorized personnel only

4 INSTRUCTIONS FOR THE UPS

4.1 INTRODUCTION

This chapter describes how to correctly use the system.
The UPS may be in one of the following operating conditions:

- **Normal operation** - The load is supplied by the UPS.
The UPS is in normal operation and uses mains voltage to supply energy to the load and charge the batteries.
This mode guarantees complete uninterrupted power passed to the load.
- **Operation with internal automatic by-pass** - The load is supplied by the mains.
In the event of an inverter fault and/or overload, the power to the load is provided by the reserve line.
This mode does not guarantee complete uninterrupted power passed to the load.
- **Operation with maintenance manual by-pass enabled** - The UPS is disabled.
The load is connected directly to the mains through the maintenance or emergency manual by-pass line.
This mode does not guarantee complete uninterrupted power passed to the load.
- **Battery operation** - The load is supplied by the UPS.
The UPS is in normal operation and uses the battery energy to supply the load due the mains voltage absence.
This mode guarantees complete uninterrupted power passed to the load.

4.2 POWER SWITCHES

The system maintenance elements are located behind the front doors, installed horizontally and described in order from left to right side (refer to the fig. 4.3):

MAINS INPUT SWITCH (I1): connects the UPS to the mains voltage.

RESERVE INPUT SWITCH (I2): connects the UPS to the reserve line voltage.

MANUAL BYPASS SWITCH (I3): allows disconnecting the entire UPS and providing mains supply to the load. This switch is protected with the small padlock to avoid accidental use.

UPS OUTPUT SWITCH (I4): connects the UPS to the load.

Above has been described UPS switches. There are also battery breakers, placed inside battery module and in every external battery module

To completely isolate the unit from hazardous voltages it is necessary to open also the battery switch, which is not present on the UPS.
Also remember about the presence of potentially charged capacitors inside the converter
It means that you must wait for at least 10 min. before accessing to the internal parts of the UPS.



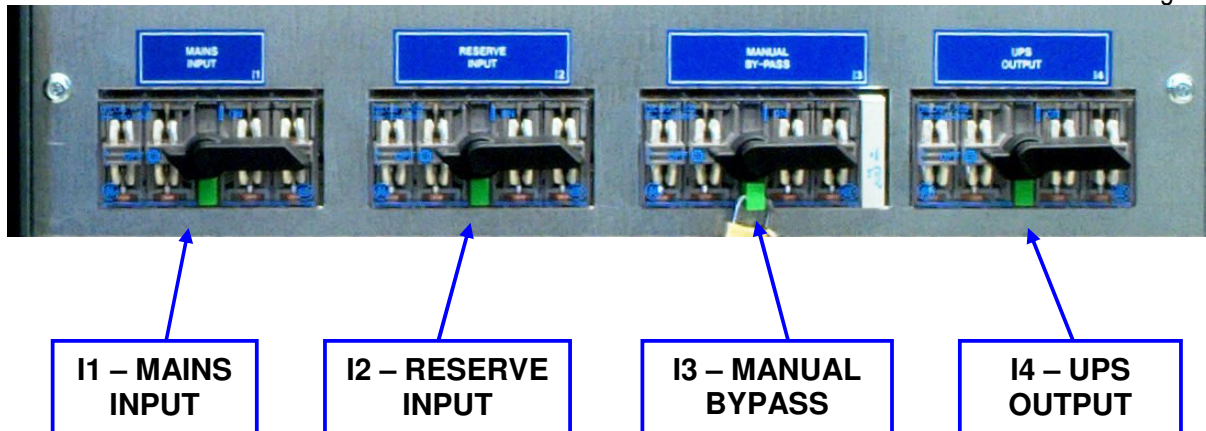
ATTENTION !



THE SWITCH IN DOWN POSITION MEANS THAT THE CIRCUIT IS OPEN
 THE SWITCH IN UP POSITION MEANS THAT THE CIRCUIT IS CLOSED

The figure 4.3 presents all the switches in OFF position.

Fig 4.3





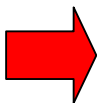

ATTENTION

*All the operations described below can be executed
 by authorized electrician or qualified personnel only*

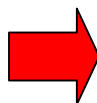
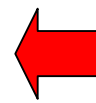
4.3 UPS START-UP PROCEDURE

This procedure describes how to setup the UPS to normal operation starting from the system completely de-energized.

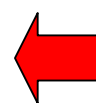
Prior to proceed, make sure that all electrical connections of the system are controlled by authorized person and all external power breakers remain close.



Verify if MANUAL BY-PASS I3 switch remains in OFF state (down position) and it's blocked mechanically with the padlock



Verify if the direction of phase rotation for mains and reserve lines is correct



For the switches explanations refer to the fig. 4.3.

If all of the points above have been verified, you can proceed following the procedure below:

1. Close the INPUT RESERVE (I2) switch

The LCD panel and all UPS logic boards will begin normal operation.

If the reserve line voltage parameters are correct, the UPS fans will switch on.

2. Close the UPS OUTPUT (I4) switch

The load connected to the UPS output will be supplied with the power provided by the reserve line.

3. Close the MAINS INPUT (I1) switch

Wait for about 10 seconds. In this time will be initiated progressive capacitors pre-charge process, which protects the mains from overload.

The **INVERTER OFF** message will appear on the LCD.

4. Switch on the inverter

Using menu **1. CONTROL MODE** select **Inverter ON** and press ENTER

In this way the inverter will be activated

5. Verify the UPS operating status

Wait about 30 seconds, after which the static switch should automatically switch the load from reserve line to inverter.

Check the correct operating status, indicated by the green LED on the control panel.

6. Battery connection

After checking the correct polarity of the batteries close the battery panel switch. It makes the connection between the batteries and the UPS circuits.

At this point the unit is in normal operating mode, and guarantees uninterrupted power supply to the load.

It is suggested to simulate the short power failure to check the correct operation of the entire UPS / battery system. To perform this operation just open and then close the mains switch powering the UPS.

4.4 INSTRUCTIONS FOR SWITCHING SYSTEM TO MANUAL BY-PASS MODE

If for maintenance purposes or other reasons the UPS must be excluded from the system, providing at the same time mains power to the critical load, proceed as follows:

1. Select menu 1. CONTROL MODE

Select the item **Transfer load to reserve network** and press ENTER
From this moment the load is supplied directly from the reserve network

2. Turn off the inverter

Using menu **1. CONTROL MODE** select **Inverter ON/OFF** and press ENTER
This turns off the inverter and uninterrupted supply is no longer guaranteed to the load

3. Close MANUAL BY-PASS (I3) switch

Remove the padlock (or any other mechanical safety lock) from the switch and lift the knob to ON position

4. Open the INPUT MAINS (I1) switch

5. Open the INPUT RESERVE (I2) switch

The load is supplied directly from the mains through the manual By-Pass

6. Open UPS OUTPUT (I4) switch

7. Disconnect the battery



At this point the load is supplied directly by the reserve network and inside the UPS there are not hazardous voltages, except of the compartment (covered with metal panel) where the input and output cables are connected, and - for few minutes - inverter DC and AC capacitors (also covered with metal panel).

4.5 INSTRUCTIONS FOR RETURN FROM MANUAL BY-PASS MODE TO NORMAL OPERATION

To return to normal operation from the manual bypass mode, proceed as follows:

1. Close the *INPUT RESERVE (I2) switch*

At this point, if the supply of the reserve line is present and within allowed range, the LCD display will switch on and also all UPS circuits will init their operations.

2. Close *UPS OUTPUT (I4) switch*

3. Open *MANUAL BY-PASS (I3) switch*

At this point the load will be supplied from the reserve line.

Mount the padlock on the manual by-pass switch (I3)

4. Close the *INPUT MAINS (I1) switch*

Wait for about 10 seconds. In this time will be initiated progressive capacitors pre-charge process, which protects the mains from overload.

The **INVERTER OFF** message will appear on the LCD.

5. Switch on the inverter

Using menu **1. CONTROL MODE** select **Inverter ON/OFF** and press ENTER

6. Verify the *UPS operating status*

Wait about 30 seconds, after which the static switch should automatically switch the load from reserve line to inverter.

Check the correct operating status, indicated by the green LED on the control panel.

7. Battery connection

After checking the correct polarity of the batteries close the battery panel switch. It makes the connection between the batteries and the UPS circuits.

4.6 INSTRUCTIONS FOR COMPLETE SHUTDOWN OF THE UPS

If for maintenance purposes or other reasons the UPS must be switched off and do not supply the load, proceed as follows:

1. Select menu 1. CONTROL MODE

Select the item **Transfer load to reserve network** and press ENTER

From this moment the load is supplied directly from the reserve network

2. Turn off the inverter

Using menu 1. **CONTROL MODE** select **Inverter ON/OFF** and press ENTER

This turns off the inverter and uninterrupted supply is no longer guaranteed to the load

3. Open UPS OUTPUT (I4) switch

Power supply to the load is not supplied

4. Open the INPUT RESERVE (I2) switch

5. Open the INPUT MAINS (I1) switch

6. Disconnect the battery



At this point the load is supplied directly by the reserve network and inside the UPS there are not hazardous voltages, except of the compartment (covered with metal panel) where the input and output cables are connected, and - for few minutes - inverter DC and AC capacitors (also covered with metal panel).

4.7 E.P.O. (EMERGENCY POWER OFF) STOP

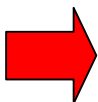
The purpose of the emergency stop is to completely shut down the UPS if necessary, with the resulting instant switch off the static switch from both reserve and inverter sources. This eliminates any power presence at the UPS output and - in consequence - at the load.

Obviously, hazardous voltages remain inside the UPS panel.

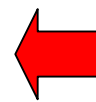
To reset EPO mode, the complete UPS shut down procedure is required.

4.8 INSTRUCTIONS FOR TURNING ON THE UPS IN POWER SAVE MODE

This procedure must be followed to start the UPS beginning from a completely de-energized state. Prior to proceed, make sure that all electrical connections of the system are controlled by authorized person and all external power breakers remain close.



Verify if MANUAL BY-PASS I3 switch remains in OFF state (down position) and it's blocked mechanically with the padlock



Verify if the direction of phase rotation for mains and reserve lines is correct



For the switches explanations refer to the fig. 4.3.

If all of the points above have been verified, you can proceed following the procedure below:

1. Close the INPUT RESERVE (I2) switch

The LCD panel and all UPS logic boards will begin normal operation.

If the reserve line voltage parameters are correct, the UPS fans will switch on.

2. Close the UPS OUTPUT (I4) switch

The load connected to the UPS output will be supplied.

3. Close the MAINS INPUT (I1) switch

Wait for about 10 seconds. In this time will be initiated progressive capacitors pre-charge process, which protects the mains from overload.

The **INVERTER OFF** message will appear on the LCD.

4. Switch on the inverter

Using menu **1. CONTROL MODE** select **Inverter ON/OFF** and press ENTER

Check the correct operating status, indicated by the green LED on the control panel.

5. Battery connection

After checking the correct polarity of the batteries close the battery panel switch. It makes the connection between the batteries and the UPS circuits.

At this point the unit is in normal operating mode, and guarantees uninterrupted power supply to the load. It is suggested to simulate the short power failure to check the correct operation of the entire UPS / battery system. To perform this operation just open and then close the mains switch powering the UPS.

4.9 INSTRUCTIONS FOR SWITCHING SYSTEM IN POWER SAVE MODE TO MANUAL BYPASS MODE

If for maintenance purposes or other reasons the UPS must be excluded from the system, providing at the same time mains power to the critical load, proceed as follows:

1. Turn off the inverter

Using menu **1. CONTROL MODE** select **Inverter ON/OFF** and press ENTER

This turns off the inverter and uninterrupted supply is no longer guaranteed to the load

2. Close MANUAL BY-PASS (I3) switch

Remove the padlock (or any other mechanical safety lock) from the switch and lift the knob to ON position

3. Open the INPUT MAINS (I1) switch

4. Open the INPUT RESERVE (I2) switch

The load is supplied directly from the mains through the manual By-Pass

5. Open UPS OUTPUT (I4) switch

6. Disconnect the battery



At this point the load is supplied directly by the reserve network and inside the UPS there are not hazardous voltages, except of the compartment (covered with metal panel) where the input and output cables are connected, and - for few minutes - inverter DC and AC capacitors (also covered with metal panel).

4.10 INSTRUCTIONS FOR RETURN FROM MANUAL BY-PASS MODE TO NORMAL OPERATION IN POWER SAVE MODE

To return to normal operation from the manual bypass mode, proceed as follows:

1. Close the *INPUT RESERVE (I2) switch*

At this point, if the supply of the reserve line is present and within allowed range, the LCD display will switch on and also all UPS circuits will init their operations.

2. Close *UPS OUTPUT (I4) switch*

3. Open *MANUAL BY-PASS (I3) switch*

At this point the load will be supplied from the reserve line.

Mount the padlock on the manual by-pass switch (I3)

4. Close the *INPUT MAINS (I1) switch*

Wait for about 10 seconds. In this time will be initiated progressive capacitors pre-charge process, which protects the mains from overload.

The **INVERTER OFF** message will appear on the LCD.

5. Switch on the inverter

Using menu **1. CONTROL MODE** select **Inverter ON/OFF** and press ENTER

Check the correct operating status, indicated by the green LED on the control panel.

6. Battery connection

After checking the correct polarity of the batteries close the battery panel switch. It makes the connection between the batteries and the UPS circuits.

4.11 INSTRUCTIONS FOR COMPLETELY SHUTTING OFF THE UPS IN POWER SAVE MODE

If for maintenance or other reasons you want to completely shut off the system and leave the uses not fed proceed as follows:

1. Turn off the inverter

Using menu 3. CONTROL MODE select Inverter ON\OFF and press ENTER

This turns off the inverter and uninterrupted supply to the uses is no longer guaranteed

2. Open LOAD I3 circuit breaker

In this situation the loads are not fed

3. Open the RESERVE INPUT I2 circuit breaker.

4. Open the MAINS I2 circuit breaker.

5. Disconnect the Battery



At this point the load is supplied directly by the reserve network and inside the UPS there are not hazardous voltages, except of the compartment (covered with metal panel) where the input and output cables are connected, and - for few minutes - inverter DC and AC capacitors (also covered with metal panel).

4.12 MANAGING THE UPS BATTERY

In addition to the battery voltage and current measurements, displayed in menu “2. MEASUREMENTS”, it is also possible to test the battery efficiency without any interruption to the load.

The test uses the input thyristors to lower the converter voltage until the battery discharge threshold; if the latter is efficient, at 2V/el it starts to providing current.

In case of battery failure, the message “*BATTERY TEST FAILED*” will be displayed on the LCD.

In this situation call the technical assistance centre.

5 UPS IN PARALLEL

5.1 SYSTEM SET-UP

The installation of many UPS in parallel requires creating one or more panels of the single UPS. The type of panel created guarantees different levels of operation based on the complexity of the adopted solution. The typical, normally suggested solution is described below, which guarantee complete operation of the system. (fig.5.1)

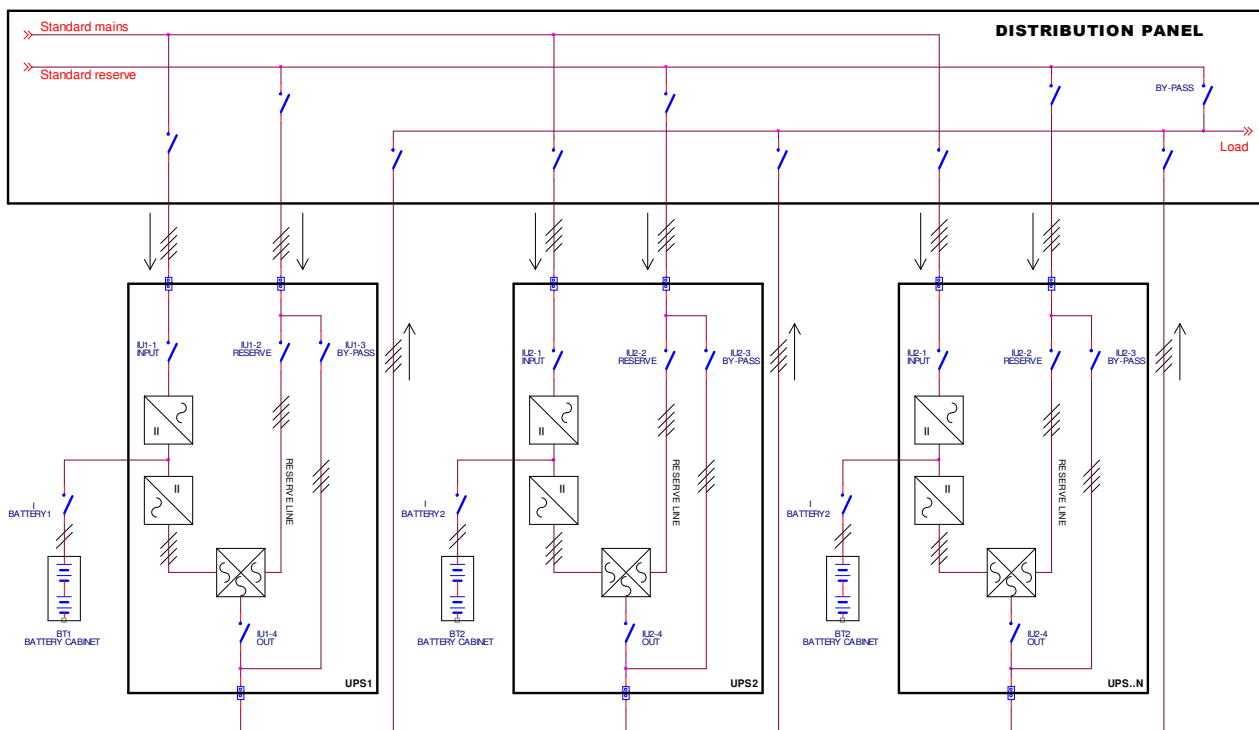
Disconnections are included on all the power lines of the single groups, disconnection of the their return line and protection of the batteries.

Moreover, it is advisable to set-up a general by-pass for the system, for this purpose implementation of a functional interlocking device is recommended.

This interlocking device is necessary to prevent damage to the system

The indicated solution permits all the testing operations in the installation and maintenance phases of the single groups.

The general manual by-pass can be used to isolate the entire system without load supply interruptions.



The complexity of the system requires opportune monitoring of the status of each UPS by remote or SNMP see chap. 1.2.4 page 7

For additional information, see the attached technical report DT0367. (only for parallel systems)

6 TROUBLESHOOTING

6.1 GENERAL ALARMS

In the event of a UPS fault, the default screen will be replaced by one of the alarm messages shown in the table below:

Alarms Messages	CAUSES	ACTIONS
INVERTER OFF	Initial start-up Permanent overload	Start the inverter Check the output
INVERTER OVERLOAD	Continuous overload on UPS output	Check the output load and restart the inverter Check the output short circuit
STATIC SWITCH BLOCKED	High transient loads on UPS output 3 failed switching attempts on inverter	Check the output load and restart the inverter
BATTERY FAULT BATTERY TEST FAILED	Battery test not OK	Check the battery Check the battery fuses
BATTERY PREALARM	Battery almost discharged, the inverter is about to go off	Shut down the connected loads which are not vital
STATIC SWITCH FAULT	One or more output phases missing	Check SCR of the by-pass Check external connections of the by-pass
MANUAL BY-PASS ENABLED	UPS in maintenance	
MAINS NOT SUITABLE	The switch is open. No mains input	Check the mains line voltage and the switch positions
RESERVE NOT SUITABLE	The rotation of the input phase is not correct. No input voltage	Check the voltage of the by- pass line Check the network cyclic direction
EMERGENCY STOP	The EPO control has been activated	Restart the UPS Completely close the switches and battery fuses, wait until the LCD is completely off and then restart the UPS
BATTERY CHARGER FAULT	The B.C. is not correctly connected or is broken	Call technical assistance
NO PARALLEL DATA EXCHANGE	The machine is disabled due to no communication	Call technical assistance

When an UPS experiences the fault which cannot be resolved and it is not able to guarantee uninterrupted power to the load, perform an EMERGENCY BY-PASS and then leave the machine isolated and off. Call the technical assistance.

6.2 CASE OF THE FIRE

In the almost impossible case of fire, remember to only use CO2 or powder extinguishers. Always activate the emergency BY-PASS and completely shut off the machine, disconnecting the battery panel as well.

6.3 FAULTS RELATED TO THE LOAD

Many times normal UPS reactions to the non-standard load or installation environment are incorrectly recognized by the users as the UPS faults.

The most common situations are described below:

- The UPS is left with load supplied by the reserve line even if the inverter section is operating correctly: this may occur on excessive absorbed peak current. It causes the major drop-down voltage, which – if is repetitive - leads to the switching load to the reserve line.

The system, after three failed attempts to switch and return to the inverter, blocks the static switch on the reserve line to protect the inverter, therefore it is necessary to study the load current and eliminate the causes of the overcurrents.

The repetitive peak current should not exceed 2.5 times the effective value.

- The accuracy of the UPS output voltage is not optimal: this may depend on an excessively unbalanced and/or distorting load.

7 SCHEDULED MAINTENANCE

The UPS while its lifetime requires **scheduled maintenance cycles** to maintain operating reliability and efficiency.

Scheduled maintenance must be performed by the company which provided the machine or company specialized and trained on the system by the seller.

7.1 ANNUAL MAINTENANCE (OR performed EVERY SIX MONTHS IN THE CASE OF UNITS IN CRITICAL APPLICATIONS)

The following actions and tests are performed while the scheduled maintenance:

- cleaning the machine
- cleaning the control logic and interface boards
- checking the tightening of all nuts and bolts and electrical connections (UPS and battery)
- testing the ventilation efficiency
- testing the inverter output wave form
- testing output voltage / frequency
- testing synchronization
- testing signals, alarms and EPO tripping
- display calibration with calibrated instrument
- operating test of manual switches and automatic devices
- operating test of switching circuits
- power failure test of UPS line, battery efficiency test and test of correct battery charger operation.

7.1 SCHEDULED COMPONENTS REPLACEMENT

- Every three years the axial 120x120 mm fans with continual service and centrifugal fans need to be replaced
- All the power electrolyte capacitors need to be replaced every four years
- The AC power capacitors need to be replaced every 6 years